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(54) Steam injection apparatus and laundry appliance comprising the steam injection apparatus

(57) The steam injection apparatus according to the present invention is intended for introducing steam into a drum 2 of a laundry appliance 1, wherein the steam injection apparatus comprises a nozzle 11. In particular, the nozzle 11 may be a multi-component nozzle. Specially, at least two of the components of the multi-component nozzle 11 are detachable from each other. The inventive laundry appliance 1 comprises the inventive steam injection apparatus.

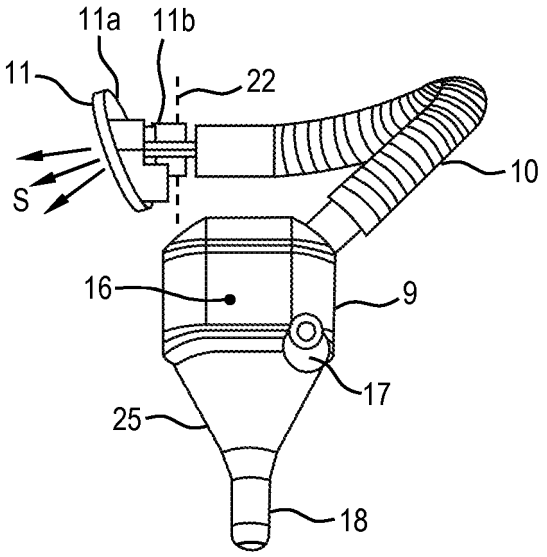

Fig.6

EP 2 287 388 A1

Description

[0001] The invention relates to a steam injection apparatus for introducing steam into a drum of a laundry appliance, and to a laundry appliance comprising the steam injection apparatus.

[0002] DE 34 08 136 A1 relates to a tumble dryer comprising a venturi-type mixing tube which is fed with steam via a gas feeding pipe and water via an inlet. In the venturi-type mixing tube water is atomized due to the effect of the steam coming out of a nozzle, whereby a steam/water mist with extremely fine droplets is created. This mixture is sprayed into an inside of a drum as a mist cloud. Thus, textile material can be moistened and subsequently dried.

[0003] WO 1996/032607 A1 relates to a steam generator, in particular for housework, and concerns a method and a device for automatically carrying out a replenishment of a tank of the steam generator during normal operation thereof. In particular, it is disclosed that by means of a temperature detector, a temperature is measured inside a cell box which is in communication with the tank. When the level of liquid, e.g. water, inside the cell box reaches a minimum level, the temperature detector is surrounded by steam, the temperature of which is higher with respect to the temperature of the liquid, and enables liquid supply by means for feeding liquid to the cell box, thus replenishing the tank up to an operational level, when the liquid enters the cell box, it cools the temperature detector which disables the liquid feeding means, cutting off inflow of cold liquid to the cell box.

[0004] EP 1 026 306 B1 relates to an automatic refill steam generator for use in conjunction with steam cleaning equipment, clothes irons, fan-assisted ironing boards with refill function, coffee and similar brewing machines. The automatic refill steam generator is provided with at least an electric heating element attached to the outside of the steam generator and equipped with a control thermostat, said steam generator being connected on one side to a water reservoir via a pump and at least a pipe, and being further connected on the other side to the steam using apparatus via a pipe.

[0005] U. S. Patent 4,207,683 relates to a clothes dryer having a touch-up spray for removal of wrinkles from clothing and fabrics and permanent press clothing, in particular without removing possibly present factory set creases. The clothes dryer may include a water heating unit for spraying water of a selected temperature or steam. The steam is applied to remove undesired wrinkles or odours from the laundry being treated and thus provides refreshment to the laundry. Accordingly, this clothes dryer may be designated to be a "refresher dryer". It should be remarked that such nomination is not reserved to an appliance which is designed merely to dry laundry besides the refreshing function; instead, it will also be applied to a washer/dryer with a refreshing function.

[0006] It is an object of the present invention to provide a means for introducing steam into a drum of a laundry appliance that allows an effective refreshing and/or de-wrinkling while being easy to assemble and maintain. This object of the invention also includes specifying a laundry appliance meeting these requirements.

[0007] The object is achieved according to the features of the independent claims. Preferred embodiments can be derived, inter alia, from the dependent claims and from the subsequent disclosure.

[0008] The object is achieved by a steam injection apparatus for introducing steam into a drum of a laundry appliance, wherein the steam injection apparatus comprises a nozzle.

[0009] The nozzle allows adjusting the direction of steam into the drum as well as a shape of the steam injection. For example, the steam can be directed directly in the drum axis and onto the clothes. This improves the effectiveness of the refreshing and/or de-wrinkling function. The steam injection may generally comprise an injection of steam and /or a fine mist of water droplets.

[0010] According to the invention, the nozzle is a multi-component nozzle. Thus, the nozzle can be assembled from two or more components. This facilitates attaching the nozzle to and removing the nozzle from the laundry appliance.

[0011] Further according to the invention, at least two of the components of the multi-component nozzle are detachable from each other. Thereby, the nozzle can be at least partly disassembled which facilitates its maintenance, in particular cleaning.

[0012] It is a preferred embodiment of the invention that the multi-component nozzle comprises at least a nozzle head, the nozzle head comprising a steam injection opening. The nozzle head represents the component that mostly determines the steam forming capability. The steam forming can thus easily be adjusted by using different nozzle heads. This allows an easy adaptation of the nozzle for different laundry appliances with only minimal design changes.

[0013] It is another preferred embodiment that at least the nozzle head is detachable from the other at least one component of the nozzle. This allows easy and thorough cleaning of the nozzle head and thus avoiding a degradation of the steam forming capability.

[0014] It is a further preferred embodiment that the nozzle is connected to a steam separator via a hose, in particular a flexible hose. The hose allows a substantially free positioning of the nozzle, in particular at a bearing shield. Also, by respective dimensioning of the hose, a steam flow rate to the nozzle may be set. Additionally, the hose may produce a pressure within the steam separator wherein the pressure supports draining of water / condensate out of the steam separator.

[0015] It is even another preferred embodiment that the multi-component nozzle is a two-component nozzle, wherein the two-component nozzle comprises the nozzle head and a nozzle support part, the nozzle support part adapted to be fitted to the hose. It is the advantage of

this embodiment that the nozzle support part may be particularly designed to connect to the hose, e.g. from a different material than the nozzle head and may be attached to the laundry appliance in a different manner. Thus, the nozzle support part and the nozzle head may both be independently optimized for their respective functions. By using only two components, manufacture, assembly, and maintenance are facilitated.

[0016] To allow a particularly rugged connection to the hose and prevent slipping off of the hose, the nozzle support part is preferred to be irremovably attachable or only detachable with the help of tools. The attachment may be, for example, implemented using a screwing connection, a rivet, a welding connection etc. The support part may not be intended to be removed by a customer or user.

[0017] It is still another preferred embodiment that at least the nozzle head is removably attachable to the laundry appliance. This allows easy removal for cleaning and at the same time a stable mount. Alternatively, the nozzle head may be fixed to the nozzle support part.

[0018] In yet another preferred embodiment, at least the nozzle head is removably attachable to a bearing shield of the laundry appliance. A positioning at the bearing shield allows a mechanically rugged fixation or engagement as well as a position to direct the steam into the drum substantially without obstruction. It may be particularly advantageous to position the nozzle on an upper half of the bearing shield to be able to direct the steam flow downwards onto the clothes.

[0019] It is another preferred embodiment that the nozzle head comprises at least one engagement element, in particular clip, to removably attach the nozzle head. This allows a particularly easy attachment. The at least one clip may be clipped onto the laundry appliance, in particular the bearing shield, by a pushing motion and / or by a rotational motion (e.g. by or similar to a bayonet coupling). In particular, the nozzle head may be removed without having to use tools.

[0020] It is even another preferred embodiment that the nozzle head is attachable to an inside of a bearing shield and the nozzle support part is attachable to an outside of a bearing shield. Thus, both components can be attached to the bearing shield substantially without hindering each other.

[0021] To prevent condensate or water drops to be dragged along into the drum by the injected steam or mist, the nozzle may comprise at least one condensate drain channel. The condensate will flow down the condensate drain channel easily and to a defined location where it can be collected or drained without substantially wetting the clothes.

[0022] It is a particularly preferred embodiment that the least one condensate drain channel comprises at least one groove in the vicinity of a steam injection opening of the nozzle. The use of a groove has the advantage that it is simple to realize, can be cleaned easily and has a wear-resistant shape.

[0023] The object is also achieved by a laundry appliance comprising the steam injection apparatus according to the invention.

[0024] In accordance with a preferred embodiment, the laundry appliance is a refresher dryer.

[0025] Further, preferred embodiments of the invention are characterized by comprising one or more of the following features:

- A multi-component removable nozzle solution is applied in order to let a user or customer take it off and clean it if dirty.
- A simple rotation is needed to release at least part of the nozzle and take it off.
- Grooves are applied to a face of the nozzle in order to achieve drainage of condensed water.
- A particular shape is implemented for the nozzle to direct the steam flow directly along the drum axis.

[0026] In the following disclosure, a particularly preferred embodiment of the invention is described in greater detail with reference to the Figures of the attached drawing. In the said drawing,

Fig.1	shows an oblique view onto a laundry appliance comprising a steam generator;
Fig.2	sketches a cross-sectional side view of the steam separator;
Fig.3	sketches a cross-sectional front view of the steam separator; and
Fig.4	sketches a transparent top view of the steam separator; further,
Fig.5	shows a steam injection arrangement comprising the steam separator in a first view;
Fig.6	shows the steam injection arrangement in a second view;
Fig.7	shows a rear side view from the outside of a section of a bearing shield of the laundry appliance comprising the steam injection arrangement;
Fig.8	shows a cross-sectional side view of the bearing shield section of Fig.7;
Fig.9	shows a front side view of the bearing shield section of Fig.7;
Fig. 10	shows the front side view of Fig. 9 in greater detail;
Fig. 11	shows a back side view of the section of Fig. 10;
Fig. 12	shows a view similar to Fig. 10 with the nozzle decomposed;
Fig. 13	shows a view similar to Fig. 11 with the nozzle decomposed, and
Fig. 14	shows a section of the nozzle mounted in the bearing shield.

[0027] **Fig.1** shows a laundry appliance 1 that is a clothes dryer or refresher dryer that incorporates a clothes or laundry refreshing and de-wrinkling function by applying steam to the clothes. The laundry appliance

1 is shown without housing. In particular, the laundry appliance 1 is embodied as a tumble dryer comprising a rotatable drum 2 which holds the clothes to be dried and which may be operated by being rotated in reversing rotational directions. The drum 2 can be loaded and unloaded through an opening 3. The opening 3 is typically closed by a door (further described in Fig.2 and Fig.3). The operation of a tumble dryer as such is well-known.

[0028] To implement the refreshing function, the laundry appliance 1 comprises a steam generator 4 which is located at a bottom of the laundry appliance 1 and mounted on top of a cover 5 of a heat exchanger 6 and of which a front side F (see also Fig.2) is visible. The steam generator 4 is used to generate steam from water. Water is supplied to the steam generator 4 via a condensate container shell 7 through a flexible filling hose 8. The water supplied to the steam generator 4 is thus the condensate that is extracted from the damp clothes during the drying process. The condensate container shell 7 may additionally be filled by fresh water, e.g. at the beginning of a drying cycle, if there is not yet enough condensate to supply the steam generator 4.

[0029] The output generated by the steam generator 4 usually contains a mixture of steam and hot water and is led to a steam separator 9. The steam separator separates the steam from the hot water. The steam is fed into the drum 2 via a hose 10 that leads to a nozzle 11. The nozzle 11 opens into the drum 2 and may inject the steam directly onto the clothes or laundry. To this end, the nozzle 11 may have a shape, e.g. angular shape that allows orientation of the steam flow. The hot water is returned to a T-connector 12 located in a dryer pump reservoir via a flexible hot water return hose. Thus, the steam separator 9 ensures that only steam with a low or very low liquid content is fed into the drum 2. The steam separator 9 and the nozzle 11 are attached to a bearing shield 22 of the laundry appliance 1.

[0030] The steam generator 4 further comprises or is connected to a flexible de-aeration hose 13 that connects to a water tank (see fig.3 for further detail) of the steam generator 4. The steam generator 4 further comprises a siphon fixation 14 for holding or fixing a siphon 15.

[0031] **Fig.2** sketches a cross-sectional side view of the steam separator 9. **Fig.3** sketches a cross-sectional front view of the steam separator. **Fig.4** sketches a transparent top view of the steam separator.

[0032] Referring now to Fig.2 to Fig.4, the steam separator 9 comprises a separator housing 16. The separator housing 16 may, for example, be box-shaped or cylinder-shaped. A water / steam inlet 17, a water outlet 18, and a steam outlet 19 lead or open into the separator housing 16. The water/steam inlet 17 is provided to feed a mixture of water and steam coming from the steam generator 4 of Fig.1, as indicated by arrow W+S. The mixture of water and steam entering the separator housing 16 is separated in the housing, because the water W flows to the water outlet 18, leaving the separator housing 16 through the water outlet 18, while the steam rises up to the steam outlet 19, leaving the separator housing 16 through the steam outlet 19.

[0033] To provide a substantially disturbance-free flow of the water W through the separator housing 16, the water/steam inlet 17 is connected to the water outlet 18 by an open drain channel 20. The open drain channel 20 is formed on an upper surface of a plate-like insert 21. The open drain channel 20 may, for example, have a cross-sectional shape resembling a half-pipe. Along its flow direction, the drain channel 20 is curved, in particular basically U-shaped, to achieve a high flow velocity. A height h between the water / steam inlet 17 and the water outlet 18 can be designed according to needs.

[0034] The water outlet 18, which in general is located lower than the water/steam inlet 17, is preferably located at a bottom of the steam separator 9 at the lowest point of the separator housing 16. Therefore, the water outlet 18 may also act as a drain for condensate formed on the walls of the separator housing 16 by the steam S wherein the condensate trickles or drips down to the water outlet 18.

[0035] The open drain channel 20 allows the water W to flow through the steam separator 9 without major disturbances or turbulences. This, in turn, suppresses an accumulation of water W within the steam separator 9 that could lead to part of this accumulated water leaving via the steam outlet 19. This water going through the steam outlet 19 would then drip into the drum 2 and impair a drying result.

[0036] The steam outlet 19 is positioned directly above the drain channel 20. Thus, the steam S being injected into the separator housing 16 and/or being emitted from the hot water W can rise up uninhibited to the steam outlet 19.

[0037] For a substantially turbulence-free flow of the water W, the inlet 17 and the water outlet 18 have at least roughly the same cross sectional area. For a high output of the steam S, the steam outlet 19 has a larger cross sectional area than the inlet 17.

[0038] The steam outlet 19 is connected to the nozzle 11 via the flexible hose 10, as shown in Fig.1, the nozzle 11 opening into the drum 2.

[0039] **Fig.5** and **Fig.6** show the steam injection arrangement 9, 10, 11 for the laundry appliance 1 from different angles. The steam injection arrangement 9, 10, 11 comprises the steam separator 9, wherein its steam outlet 19 is connected to the nozzle 11 via the flexible silicone hose 10. The steam S leaving the steam outlet 19, as indicated by the respective arrow S, flows through the hose 10 and to the nozzle 11. The nozzle 11 opens into the drum 2 of the laundry appliance 1, i.e. comprises a steam injection opening 23 or window through which the steam S is injected into the drum 2, as indicated by the respective arrow. As described in greater detail in Fig.2 to Fig.4, the steam separator 9 is fed with water and steam W + S through the water/steam inlet 17, and water W exits the steam separator 9 through the water outlet 18.

[0040] The water outlet 18 is located at the lowest point of the steam separator and attached to a cone-shaped part 25 of the steam separator 9 to drain as much water as possible from the steam separator 9.

[0041] The steam separator 9, at the outside of its housing 16, comprises only one fixation element or fixation point 26 to screw the steam separator 9 to the bearing shield 22.

[0042] At the rear side of the nozzle 11 that is facing the bearing shield 22 there are located several engagement means embodied as clips 24 to clip the nozzle 11 at the bearing shield 22. This ensures a secure fastening. On the other hand, the nozzle 11 can be taken off, e.g. for cleaning the nozzle 11. To this end, the bearing shield 22 comprises an opening (not shown) to insert the nozzle 11 and/or the hose 10.

[0043] In particular, the nozzle 11 can be a two-part nozzle 11, with a nozzle head 11a comprising the clips 24 and a nozzle support part 11b. The nozzle support part 11b may be attached to an outside of the bearing shield 22, as described in Fig.7 to Fig.9, to provide a fixed and immovable connection for the hose 10. The nozzle support part 11b is thus adapted to attach the hose 10 thereon. The nozzle head 11a may then be plugged together with the nozzle support part 11b from the inside of the bearing shield 22 and be clipped to the bearing shield. In this case, cleaning of the nozzle 11 in particular includes cleaning of the nozzle head 11a.

[0044] Thus, the whole steam injection arrangement 9, 10, 11 can be fixed to the laundry appliance 1 by one screwing action to screw the steam separator 9 to the bearing shield 22 and one clipping action to clip the nozzle 11 to the bearing shield 22.

[0045] As indicated in Fig.6, the nozzle 11 is inclined with respect to the bearing shield 22, wherein the orientation of the bearing shield 22 is indicated by the dashed line. The inclination allows the steam S exiting from the nozzle 11 to be directed downwards to a lower region of the drum 2 and thus directly onto the clothes to be refreshed and/or de-wrinkled. This arrangement implies that the nozzle 11 is positioned at an upper half of the bearing shield 22, in particular at a region of the bearing shield 22 surrounding an upper half of the opening 3.

[0046] **Fig.7** shows a sectional cut-out of a rear side 22r of the bearing shield 22 of the laundry appliance 1 comprising the steam injection arrangement 9, 10, 11. The steam separator 9 is screwed to the bearing shield 22 at its fixation point 26, and the nozzle 11 is also fixed to the bearing shield 22 with the hose 10 connecting the steam separator 9 and the nozzle 11. Of the nozzle 11, only the nozzle support part 11b is visible which is mounted to the outside of the bearing shield 22. The hose 10 is put on the nozzle support part 11b.

[0047] **Fig.8** shows a cross-sectional side view of the bearing shield 22. The nozzle 11 or nozzle head 11a is inclined downwards with respect to the inside of the bearing shield 22 to directly inject the steam onto the clothes.

[0048] **Fig.9** shows a sectional cut-out of a front side 22f (looking from inside the drum 2) of the bearing shield 22. The nozzle head 11a is inserted into the respective opening 28 within the bearing shield 22. The engagement of the nozzle head 11a to the bearing shield by means of the clips may be effected by a pushing action and / or a rotating action. Thus, the nozzle head 11a may be removed by a simple pulling action and/or (counter-) rotating action.

[0049] There are special grooves 29 on a face of the nozzle head 11a in order to achieve drainage of condensate water that may form during injection of the steam S. The grooves 29 drain and channel the condensate in the direction of the bearing shield and thus away from the steam injection opening 23. This suppresses the dripping or dragging of water drops onto the clothes.

[0050] **Fig. 10** shows a detailed cut-out of the front side 22f of the bearing shield 22 in the vicinity of the nozzle 11 with the nozzle 11 inserted. **Fig. 11** shows a detailed cut-out of the rear side 22r of the bearing shield 22 in the vicinity of the nozzle 11 with the nozzle 11 inserted. **Fig. 12** shows the cut-out of the front side 22f of Fig. 10 with the nozzle 11 in an exploded view. **Fig. 13** shows the cut-out of the rear side 22r of Fig. 11 with the nozzle 11 in an exploded view.

[0051] Referring now to Figs. 10 to 13, nozzle head 11a comprises a front disk 30 that in its center comprises the steam injection opening 23. From the rear side of the nozzle head 11a extends a tube socket 31 that is connected to the steam injection opening 23. The two clips 24 are extending sideways of the tube socket 31. The nozzle head 11a, if looked upon from the side, is at least partially wedge-shaped with an additional rear plate 32 being inclined to the front disk 30. The wedge-shape ensures a desired inclination angle of the nozzle head 11a into the drum 2.

[0052] The nozzle head 11a is to be fitted into the opening 28 of the bearing shield 22 by inserting it into the opening 28 from the front side 22f. The bearing shield 22 comprises two small windows for hooks (not shown). The nozzle head 11a can be pushed into the opening 28 for the clips 24 to snap or click with the hooks. If fitted into the opening 28, the tube socket 31 sticks out to the rear side 22r of the bearing shield 22.

[0053] The nozzle support part 11b comprises a tube socket 33, a front part of which is adapted to be plugged on or slipped on the tube socket 31 of the nozzle head 11a. A rear part of the tube socket 33 is adapted to be connected with the hose 10. The nozzle support part 11b is screwed on the bearing shield 22. To this effect, the nozzle support part 11b further comprises a double-disk like lateral support region 34 that is adapted to contact a ring-like rim or base 35 of the opening. Two mounting links 36 are laterally extending from the support region 34. The mounting links 36 are angled with respect to the support region 34 such that the support region 34 can be fitted with the inclination angle while the mounting links 36 can be fixed horizontally.

[0054] For fixing the nozzle support part 11b to the rear

side 22r of the bearing shield 22, the mounting links 36 are fitted over the respective fitting screw stubs 37. The screw stubs 37 are horizontally extending from the rear side 22r of the bearing shield 22. After slipping the mounting links 36 over the screw stubs 37, they can be screwed together by a respective screw (not shown).

[0055] **Fig.14** shows a sectional view of the bearing shield 22 and the assembled nozzle 11 of Fig.10 to Fig. 13. The tube socket 31 of the nozzle head 11a and the tube socket 33 of the nozzle support part 11b are slipped together to form a single channel 38 for guiding steam from a rear opening 39 of the tube socket 33 (the rear opening 39 opening into the hose 10) to the opening 23 of the nozzle head 11a.

[0056] Of course, the invention is not restricted to the shown embodiment. Generally, the nozzle can be a single piece or a multi-component nozzle. Also, the nozzle head can be fixed by other means than a snap connection e.g. by a screw connection.

List of Reference Numerals

[0057]

1	laundry appliance
2	drum
3	opening
4	steam generator
5	cover
6	heat exchanger
7	condensate container shell
8	filling hose
9	steam separator
10	hose
11	nozzle
11a	nozzle head
11b	nozzle support part
12	T-connector
13	de-aeration hose
14	siphon fixation
15	siphon
16	steam separator housing
17	water / steam inlet
18	water outlet
19	steam outlet
20	open drain channel
21	insert
22	bearing shield
22r	rear side of the bearing shield
22f	front side of the bearing shield
23	steam injection opening
24	clip
25	cone-shaped part
26	fixation point
28	opening of the bearing shield
29	groove
30	front disk
31	tube socket
32	rear plate
33	tube socket
34	support region
35	base
36	mounting link
37	screw stub
38	channel
39	rear opening
W	water
S	steam

Claims

1. A steam injection apparatus for introducing steam into a drum (2) of a laundry appliance (1), wherein the steam injection apparatus comprises a nozzle (11), wherein the nozzle (11) is a multi-component nozzle (11a, 11b), and wherein at least two of the components of the multi-component nozzle (11a, 11b) are detachable from each other.

2. The steam injection apparatus according claim 1, wherein the multi-component nozzle (11) comprises at least a nozzle head (11a), the nozzle head (11a) comprising a steam injection opening (23).

3. The steam injection apparatus according to claim 2, wherein at least the nozzle head (11a) is detachable from the other at least one component (11b) of the nozzle (11).

4. The steam injection apparatus according to any of the preceding claims, wherein the nozzle (11) is connected to a steam separator (9) via a hose (10), in particular a flexible hose (10).

5. The steam injection apparatus according to any of the claims 2 to 4, wherein the multi-component nozzle is a two-component nozzle (11) and wherein the two-component nozzle (11) comprises the nozzle head (11a) and a nozzle support part (11b), the nozzle support part (11b) adapted to be fitted to the hose (10).

6. The steam injection apparatus according to claim 5, wherein the nozzle support part (11b) is irremovably attachable or only detachable with help of tools.

7. The steam injection apparatus according to any of the claims 2 to 6, wherein at least the nozzle head (11a) is removably attachable to the laundry appliance (1).

8. The steam injection apparatus according to claim 7, wherein at least the nozzle head (11a) is removably attachable to a bearing shield (22) of the laundry appliance (1).

9. The steam injection apparatus according to any of the claims 7 or 8, wherein the nozzle head (11a) comprises at least one engagement element (24), in particular clip, to removably attach the nozzle head (11a).

10. The steam injection apparatus according to any of the claims 5 to 9 wherein the nozzle head (11a) is attachable to an inside of a bearing shield (22) and the nozzle support part (11b) is attachable to an outside of a bearing shield (22).

11. The steam injection apparatus according to any of the preceding claims, wherein the nozzle (11) comprises at least one condensate drain channel (29).

12. The steam injection apparatus according to claim 11, wherein the least one condensate drain channel (29) comprises at least one groove (29) in the vicinity of a steam injection opening (23) of the nozzle (11).

13. A laundry appliance (1) comprising the steam injection apparatus according to any of the preceding claims.

14. A laundry appliance (1) according to claim 13, which is a refresher dryer (1).

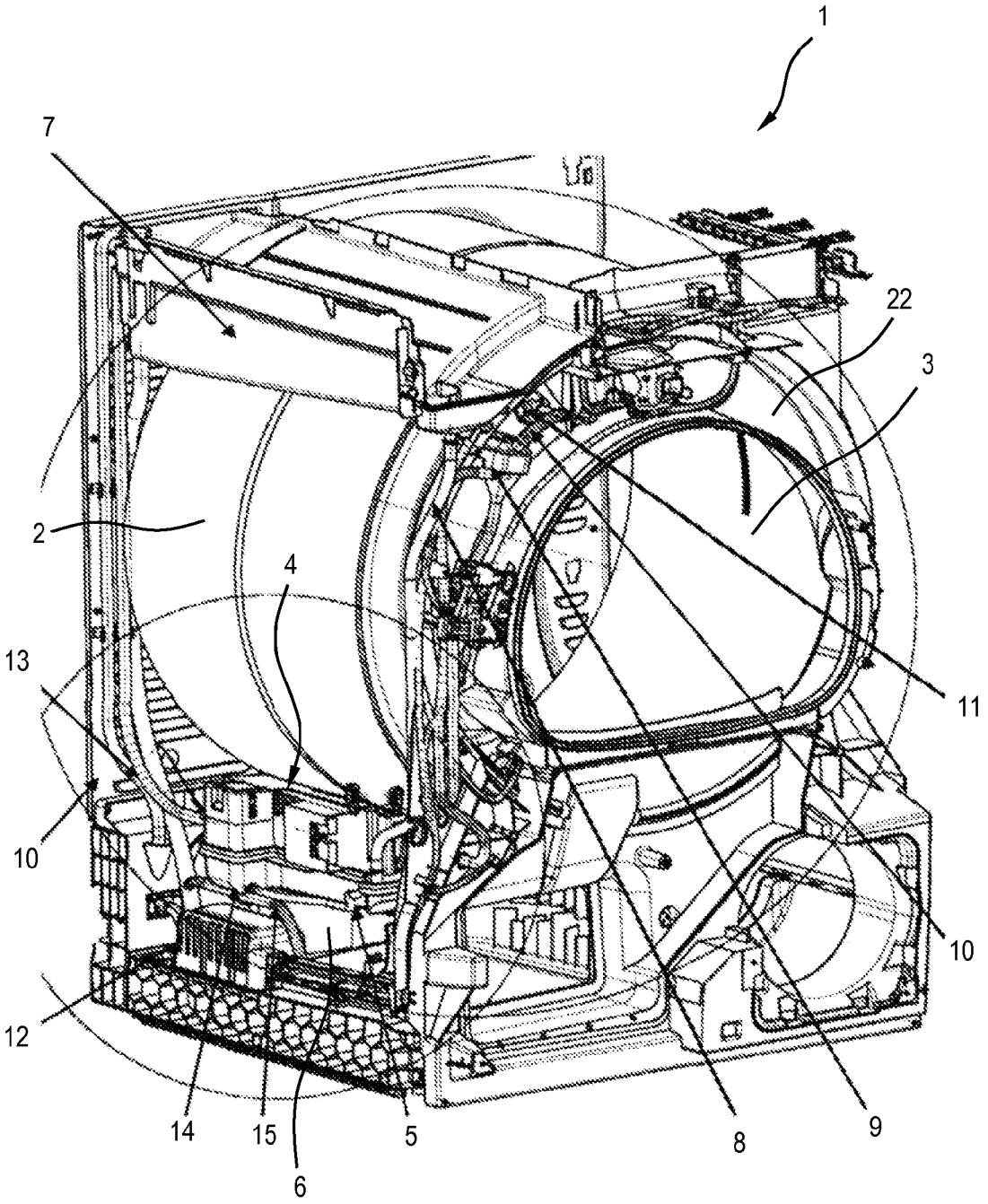

Fig.1

Fig.2

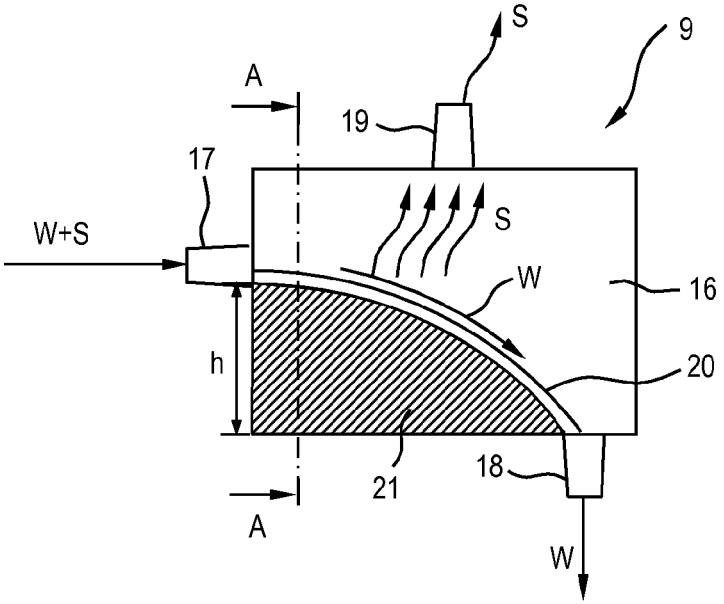

Fig.3

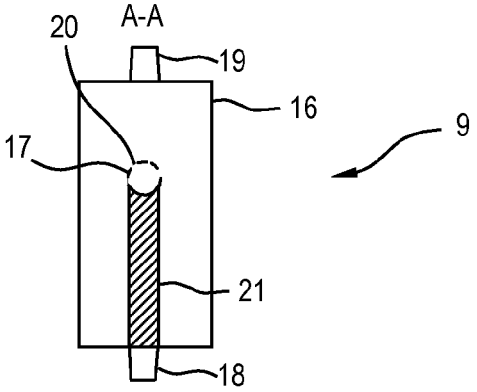

Fig.4

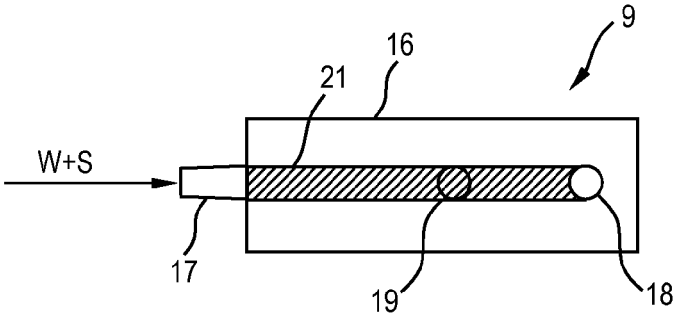

Fig.5

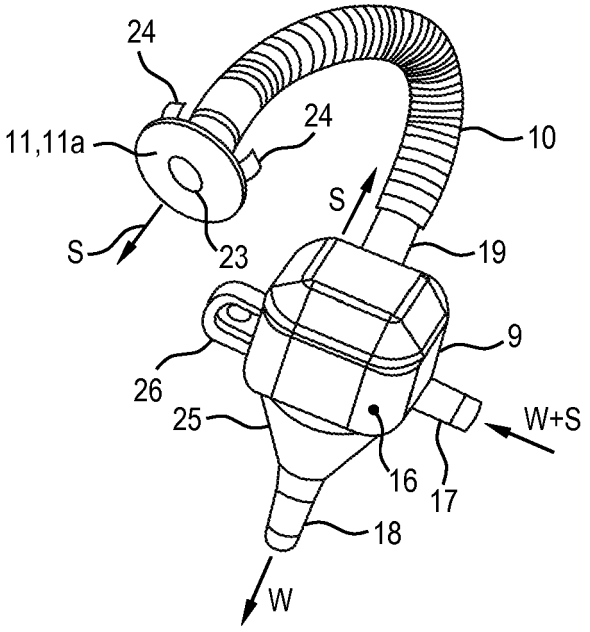
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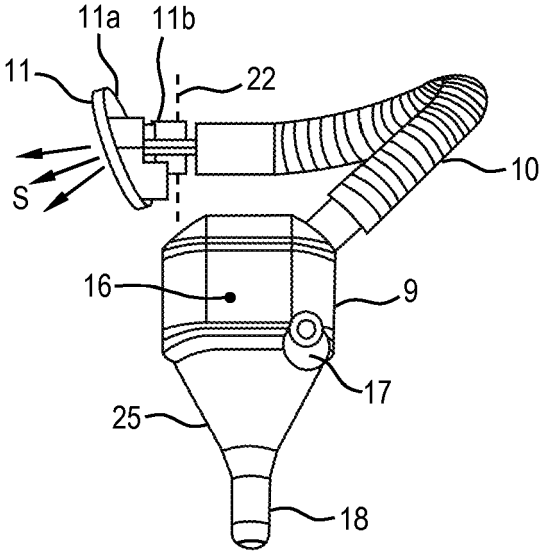
Fig.6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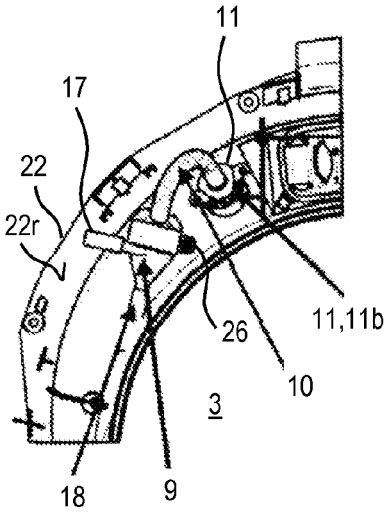


Fig.7

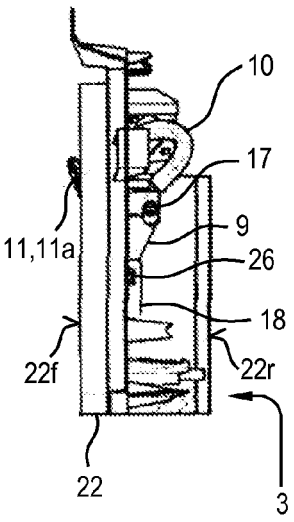


Fig.8

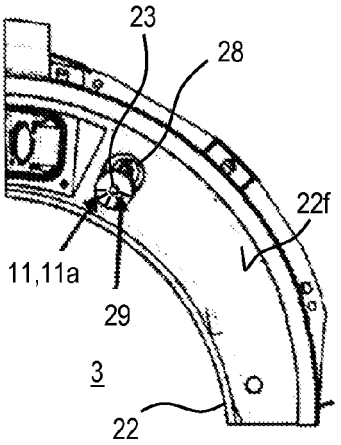


Fig.9

Fig.10

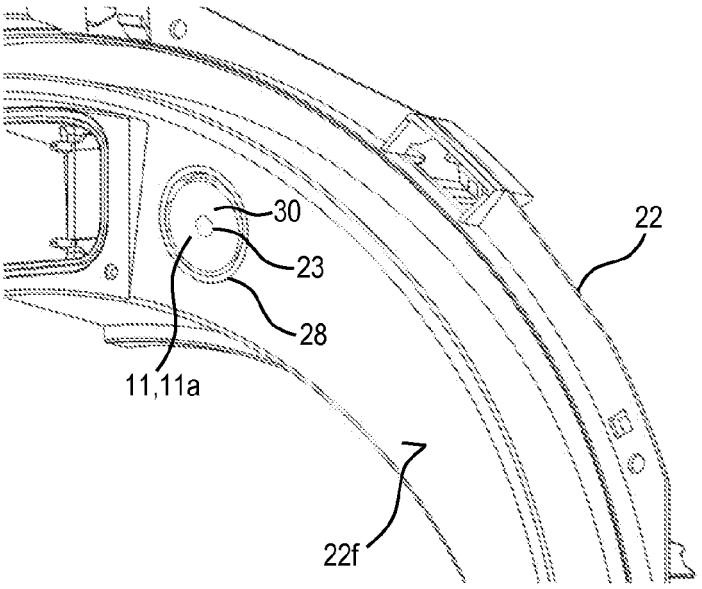


Fig.11

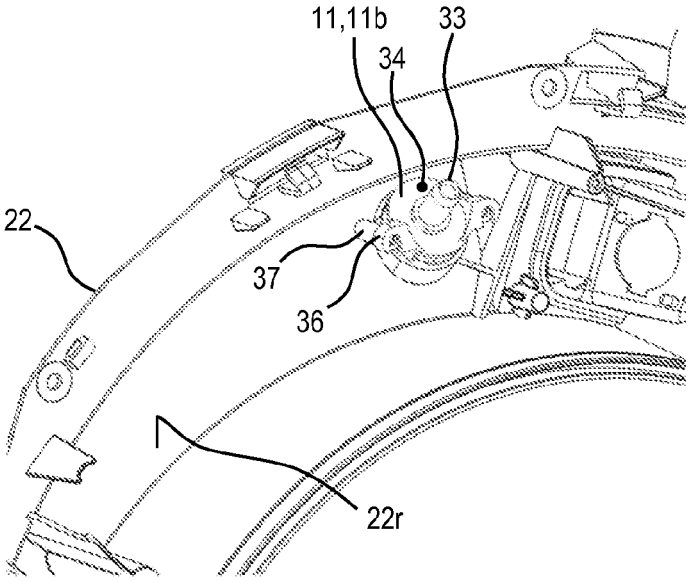
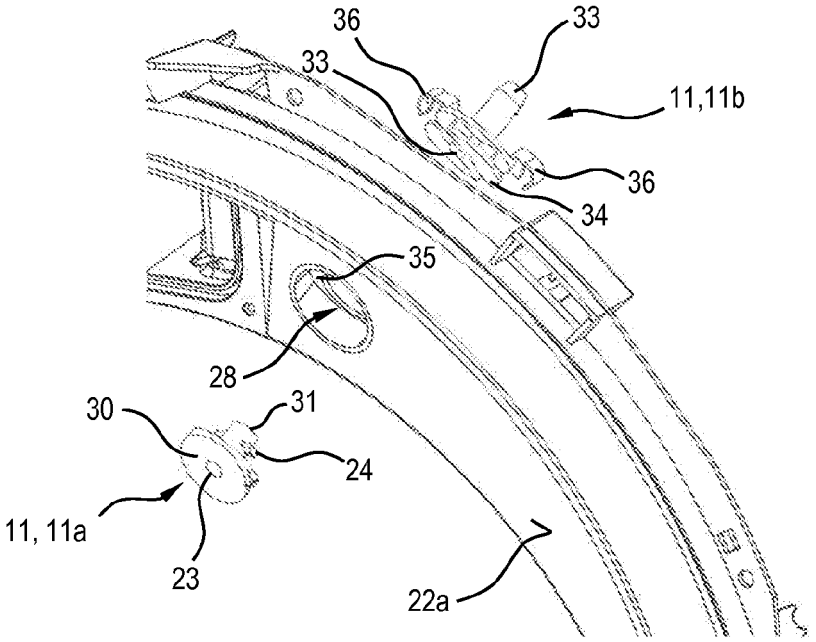


Fig.12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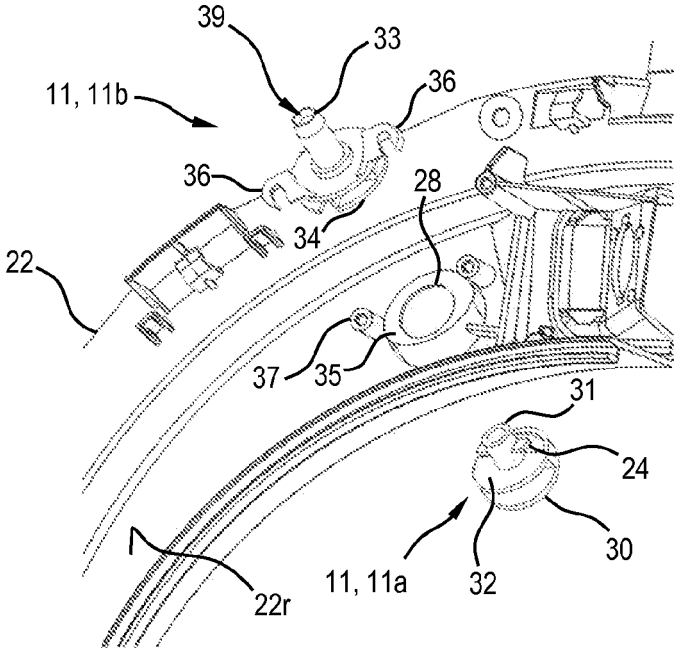
11, 11a
23
22a

Fig.13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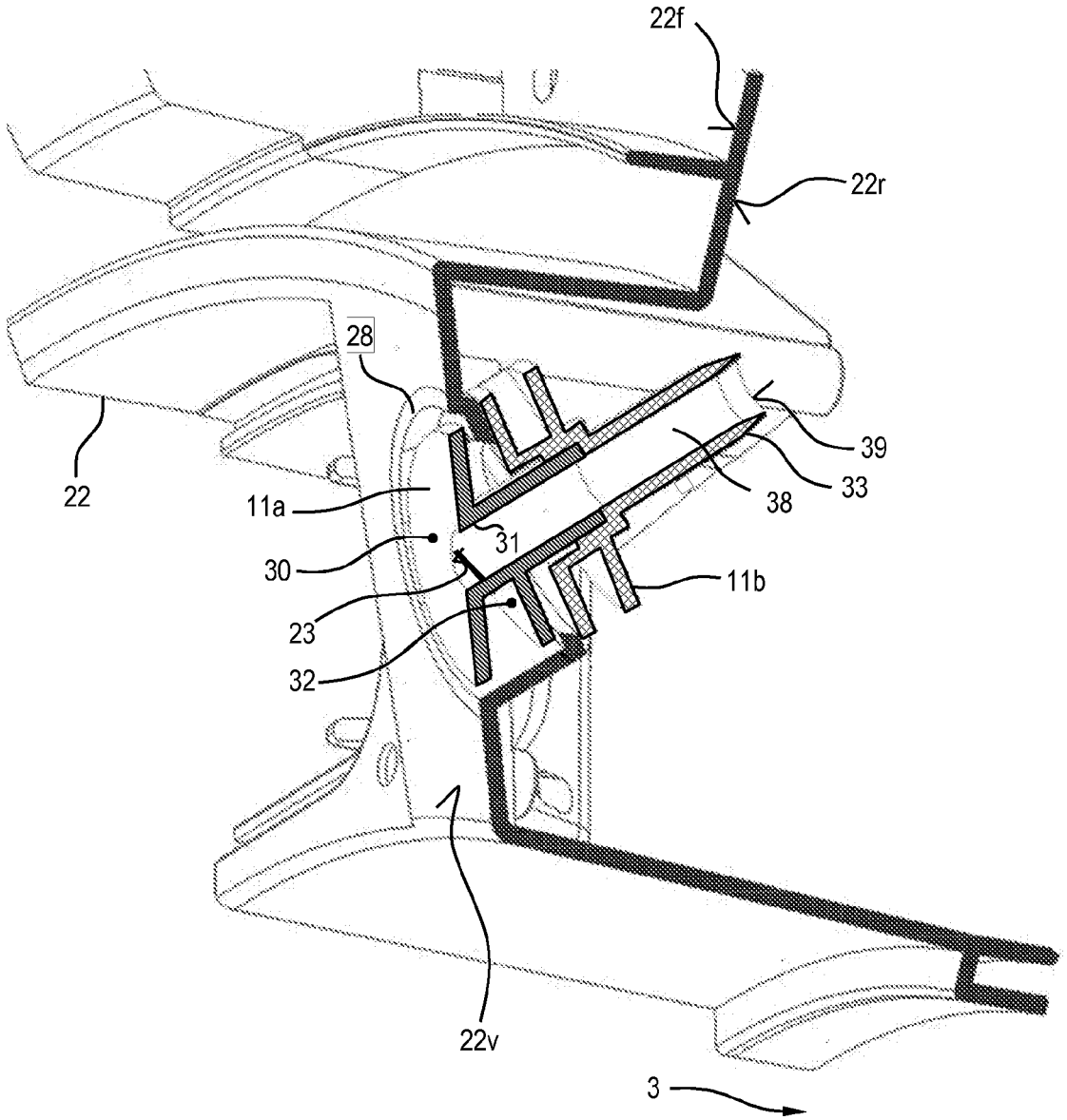

Fig.14

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